

PRACTICAL APPROACHES FOR THE DEVELOPMENT OF ALKALI ACTIVATED CONCRETE - A DURABILITY- AND SUSTAINABILITY-DRIVEN OPTIMIZATION

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Alkali activated concrete can gain high strength, nevertheless the advantage is seen in its high durability, which is related to the aluminosilicate network. Due to this and the opportunity to use high amounts of (or even primarily) industrial wastes for the binding material, alkali activated concrete represents a material with a high sustainability potential. But a broad utilization beyond special applications can only be achieved, if the cost side can compete with conventional cement concrete.

This paper discusses the strong relationship between material selection, mixture composition, and durability. Nevertheless, the final evaluation takes place concerning costs. For evaluating durability, the resistance against freezing and thawing and deicing chemicals (as one of the main criteria of concrete use in Germany) were investigated by means of CDF-test device. In addition, the production costs and the life cycle impact (LCA) were analyzed.

In extensive laboratory test series the influences of different binding material qualities including different ratios of granulated ground blast furnace slag, fly ash and a waste material from ore processing on the concrete durability were investigated, as well as evaluated concerning costs and environmental impacts. Furthermore, different activator solutions, combinations of these, as well as different alkalinity and water/binder ratios were included into the investigation and evaluation.

While in the first step, the technical results decide for the mixture to be chosen for a certain application, in the second step the costs are the tongue on the scales. Also it will be explained, that it is worth to invest into e. g. chemical admixtures, which improve technical quality and durability. A longer lifetime of the geopolymer concrete implies increased economic and ecological advantages. These result in a higher sustainability, which includes also lower total costs.

From the practical point of view it will be strongly suggested that alkaline-activated concrete compositions are to be developed with focus on the final technical product parameters, such as durability and costs, instead of theoretically calculated concrete compositions e.g. in terms of activator use.